Tow point	Position	Load		
		Magnitude	No.	Direction
	Swiveled 45° from forward	0.15W	9	Forward, in plane of wheel.
			10	Aft, in plane of wheel.
	Swiveled 45° from aft	0.15W	11	Forward, in plane of wheel.
			12	Aft, in plane of wheel.

[Amdt. 23–14, 38 FR 31821, Nov. 19, 1973]

§ 23.511 Ground load; unsymmetrical loads on multiple-wheel units.

(a) *Pivoting loads*. The airplane is assumed to pivot about on side of the main gear with—

(1) The brakes on the pivoting unit locked; and

(2) Loads corresponding to a limit vertical load factor of 1, and coefficient of friction of 0.8 applied to the main gear and its supporting structure.

(b) *Unequal tire loads*. The loads established under §§ 23.471 through 23.483 must be applied in turn, in a 60/40 percent distribution, to the dual wheels and tires in each dual wheel landing gear unit.

(c) *Deflated tire loads*. For the deflated tire condition—

(1) 60 percent of the loads established under §§ 23.471 through 23.483 must be applied in turn to each wheel in a landing gear unit; and

(2) 60 percent of the limit drag and side loads, and 100 percent of the limit vertical load established under §§ 23.485 and 23.493 or lesser vertical load obtained under paragraph (c)(1) of this section, must be applied in turn to each wheel in the dual wheel landing gear unit.

[Amdt. 23–7, 34 FR 13090, Aug. 13, 1969]

Water Loads

§ 23.521 Water load conditions.

(a) The structure of seaplanes and amphibians must be designed for water loads developed during takeoff and landing with the seaplane in any attitude likely to occur in normal operation at appropriate forward and sinking velocities under the most severe sea conditions likely to be encountered.

(b) Unless the applicant makes a rational analysis of the water loads, §§ 23.523 through 23.537 apply.

[Doc. No. 4080, 29 FR 17955, Dec. 18, 1964, as amended by Amdt. 23–45, 58 FR 42160, Aug. 6, 1993; Amdt. 23–48, 61 FR 5147, Feb. 9, 1996]

§ 23.523 Design weights and center of gravity positions.

(a) *Design weights*. The water load requirements must be met at each operating weight up to the design landing weight except that, for the takeoff condition prescribed in § 23.531, the design water takeoff weight (the maximum weight for water taxi and takeoff run) must be used.

(b) *Center of gravity positions*. The critical centers of gravity within the limits for which certification is requested must be considered to reach maximum design loads for each part of the seaplane structure.

[Doc. No. 26269, 58 FR 42160, Aug. 6, 1993]

§ 23.525 Application of loads.

(a) Unless otherwise prescribed, the seaplane as a whole is assumed to be subjected to the loads corresponding to the load factors specified in § 23.527.

(b) In applying the loads resulting from the load factors prescribed in § 23.527, the loads may be distributed over the hull or main float bottom (in order to avoid excessive local shear loads and bending moments at the location of water load application) using pressures not less than those prescribed in § 23.533(c).

(c) For twin float seaplanes, each float must be treated as an equivalent hull on a fictitious seaplane with a weight equal to one-half the weight of the twin float seaplane.

(d) Except in the takeoff condition of § 23.531, the aerodynamic lift on the seaplane during the impact is assumed to be ⅔ of the weight of the seaplane.

[Doc. No. 26269, 58 FR 42161, Aug. 6, 1993; 58 FR 51970, Oct. 5, 1993]

§23.527 Hull and main float load factors.

(a) Water reaction load factors n_w must be computed in the following manner:

(1) For the step landing case

$$n_w = \frac{C_1 V_{SO}^2}{\left(\mathrm{Tan}^{\frac{2}{3}} \beta\right) W^{\frac{1}{3}}}$$

(2) For the bow and stern landing cases

$$n_w = \frac{C_1 V_{SO}^2}{\left(\mathrm{Tan}^{\frac{2}{3}} \beta\right) W^{\frac{1}{3}}} \times \frac{K_1}{\left(1 + r_x^2\right)^{\frac{2}{3}}}$$

(b) The following values are used:

(1) n_w=water reaction load factor (that is, the water reaction divided by seaplane weight).

(2) C_1=empirical seaplane operations factor equal to 0.012 (except that this factor may not be less than that necessary to obtain the minimum value of step load factor of 2.33).

(3) V_{SO}=seaplane stalling speed in knots with flaps extended in the appropriate landing position and with no slipstream effect.

(4) β=Angle of dead rise at the longitudinal station at which the load factor is being determined in accordance with figure 1 of appendix I of this part.

(5) W=seaplane landing weight in pounds.

(6) K_1=empirical hull station weighing factor, in accordance with figure 2 of appendix I of this part.

(7) r_x=ratio of distance, measured parallel to hull reference axis, from the center of gravity of the seaplane to the hull longitudinal station at which the load factor is being computed to the radius of gyration in pitch of the seaplane, the hull reference axis being a straight line, in the plane of symmetry, tangential to the keel at the main step.

(c) For a twin float seaplane, because of the effect of flexibility of the attachment of the floats to the seaplane, the factor K_1 may be reduced at the bow and stern to 0.8 of the value shown in figure 2 of appendix I of this part. This reduction applies only to the design of the carrythrough and seaplane structure.

[Doc. No. 26269, 58 FR 42161, Aug. 6, 1993; 58 FR 51970, Oct. 5, 1993]

§23.529 Hull and main float landing conditions.

(a) *Symmetrical step, bow, and stern landing.* For symmetrical step, bow, and stern landings, the limit water reaction load factors are those computed under §23.527. In addition—

(1) For symmetrical step landings, the resultant water load must be applied at the keel, through the center of gravity, and must be directed perpendicularly to the keel line;

(2) For symmetrical bow landings, the resultant water load must be applied at the keel, one-fifth of the longitudinal distance from the bow to the step, and must be directed perpendicularly to the keel line; and

(3) For symmetrical stern landings, the resultant water load must be applied at the keel, at a point 85 percent of the longitudinal distance from the step to the stern post, and must be directed perpendicularly to the keel line.

(b) *Unsymmetrical landing for hull and single float seaplanes.* Unsymmetrical step, bow, and stern landing conditions must be investigated. In addition—

(1) The loading for each condition consists of an upward component and a side component equal, respectively, to 0.75 and 0.25 tan β times the resultant load in the corresponding symmetrical landing condition; and

(2) The point of application and direction of the upward component of the load is the same as that in the symmetrical condition, and the point of application of the side component is at the same longitudinal station as the upward component but is directed inward perpendicularly to the plane of symmetry at a point midway between the keel and chine lines.

(c) *Unsymmetrical landing; twin float seaplanes.* The unsymmetrical loading consists of an upward load at the step of each float of 0.75 and a side load of 0.25 tan β at one float times the step landing load reached under §23.527. The